A STUDY OF CERTAIN SOILS FROM THE PANHANDLE OF TEXAS

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

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ENTITLED A STUDY OF CERTAIN SOILS FROM THE PANHANDLE OF TEXAS

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE DEGREE

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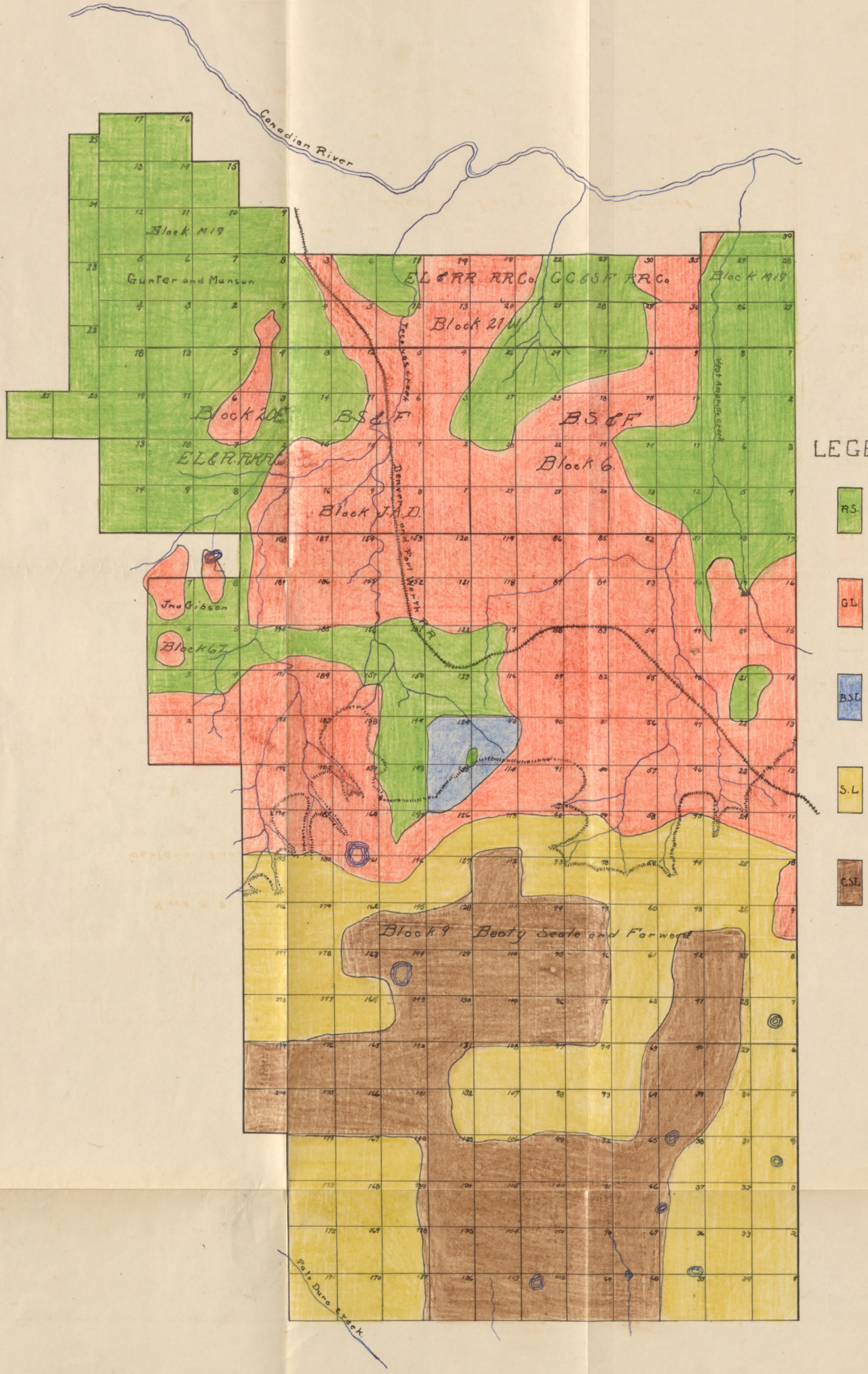
Canadian River
Block M19
Gunter and Munson
EL&RR RR Co
GC&SF RR Co
Block M19
Block 21 W
Block 20 E
B.S.&F.
B.S.&F.
EL&R.RR.Co
Block 6.
Block J.A.D.
Jno Gibson
Block 67
Block 9 Beaty Seale and Forwood
Pole Dura Creek
LEGEND
R.S.
G.L.
B.S.L.
S.L.
C.S.L.

A STUDY OF CERTAIN SOILS OF THE PANHANDLE OF TEXAS.

It was the object to make a study of the soils directly west,south west,and northwest of Amarillo,Texas.The area studied includes three hundred and fifteen sections which extend west of a line from north to south that would pass a mile west of Amarillo and south of points about one and a half miles south of the Canadian river.This land is included in blocks 9 Beaty,Seale and Forwood,6Z Jno.Gibson,6 B.S.& F.,J.A.D. B.S.& F.,21W E.L & R.R. R.R.Co. and G.C.& S.F. R.R.,M19 Gunter and Munson,and 20E E.L.& R.R. R.R.Co.,part of which is in Randall and the rest in Potter county,Texas.

A study of the soils was made to determine the various types,and while this was being done fifty-two samples were collected,part of which were analyzed to determine the fertility From this study it was found that there were five quite distinct soil types in this area,the form of which is shown on the map that is presented with this thesis.The types are a fine red sand grey loam,light brown silt loam,reddish brown silt loam,and brown clayey silt loam.

The reddish brown silt loam is the soil that is shown by the yellow color on the map and is marked S.L.Samples 4-5-7-8-10-13-15-16-17-18-27-43-45-46-48-49-52- were taken from various places in this type.All of the soil was moist,loose, and easy to sample.ALL of this type is very level prairie except the very northern portion which is very rolling and "brakey."

The brown clayey silt loam is the area repersented by the brown,marked C.S.L. on the map.It occurs in the southern part of the land surveyed and merges into the type mentioned above Samples 2-3-6-8-11-12-14-19-47 were taken to repersent this type. They are harder and more compact soils than those mentioned above and are also darker in color,being almost black.They have more clay in them and are more tenacious.It is a very smooth prairie land the same as the other type.

The small area in blue on the map marked B.S.L. is the light brown silt loam.That is it might be judged either as a light brown or a grey silt loam.It is but a small area and is repersented by sample 35.It is a small plain of about three sections in the southern edge of the breaks.It has quite a little sand and is a hard dry soil.

The grey loam is the area repersented by red marked G.L. It is repersented by samples 1-23-26-29-30-31-32-33-37-38-39-40-41-42-44-50-51.It has an appreciable amount of sand but less than fifty percent.Considerable of this is prairie land but quite a good deal especially in the northern part is rough and breakey.

The remaining type is shown on the map by the green marked R.S. and is a fine red sand.It is a deep red and is of a uniform texture.While some of this type raises grass all right the same as the other land:yet much of it is rolling and breaky and is of an inferior grade.It is repersented by the samples 21-22-24-25-28-34-36.

Table 1 shows the section from which the samples are taken.

Table 1

Sample	Section	Block	Sample	Section	Block	Sample	Section	Block
1	9	9	19	112	9	37	36	21W
2	40	9	20	16	9	38	147	9
3	99	9	21	19	9	39	146	9
4	73	9	22	79	9	40	1	J.A.D
5	29	9	23	6	21W	41	62	9
6	65	9	24	8	M19	42	23	9
7	42	9	25	21	21W	43	45	9
8	60	9	26	13	21W	44	21	9
9	77	9	27	126	9	45	56	9
10	197	9	28	6	6Z	46	98	9
11	163	9	29	15	J.AD	47	27	9
12	76	9	30	7	6Z	48	26	9
13	74	9	31	192	9	49	89	9
14	158	9	32	5	21W	50	47	9
15	170	9	33	4	20E	51	23	9
16	164	9	34	150	9	52	43	9
17	25	9	35	114	9			
18	79	9	36	8	6			

The study was made of the surface soil and the samples were taken seven to eight inches deep with an auger. This is true except in the case of the samples 21-32 which were not considered in the tables latter. Sample 21 was taken in the northeast

corner of section 19 block 9.It is some of the soft yellowish rock that underlies the sand about three feet at this place. Sample 32 is from section 5 block 21W and is the subsoil of a small strip of poor land.First the moisture in the soil was determined so that there might be an equal basis on which to figure results.Then ,as many as possible of the soils were determined for nitrogen,phosphorus,and potassium and the results are shown in the tables that follow.Table 2 shows the moisture,table 3 the nitrogen,table 4 the phosphorus,and table 5 the potassium.

Table 2 Moisture

Soil	Wt of moisture in 5 grams soil		Percent		Average %	Dry matter in 10 Grams of soil
1	.1020grs.	.1023	2.04	2.046	2.043	9.[illegible]797
2	.2110	.2105	4.275	4.26	4.2625	9.57375
3	.2115	.2115	4.27	4.27	4.27	9.573
4	.1635	.1642	3.27	3.284	3.277	9.6723
5	.2003	.2023	4.006	4.046	4.026	9.5974
6	.1775	.1787	3.55	3.574	3.572	9.6428
7	.1800	.1820	3.60	3.65	3.625	9.6375
8	.1628	.1688	3.256	3.51	3.383	9.6617
9	.1780	.1785	3.50	3.57	3.535	9.6475
10	.2165	.2145	4.33	4.29	4.31	9.569
11	.1810	.1790	3.62	3.58	3.60	9.64
12	.2310	.2333	4.62	4.666	4.643	9.5357
13	2077	.2090	4.154	4.18	4.167	9.7833
14	.1966	.1950	3.932	3.90	3.916	9.6084

Table 2 continued

Soil	Wt of moisture in 5 grams soil		Percent		Average %	Dry matter in 10 grams of soil
15	.1602	.1606	3.205	3.216	3.2105	9.67895
16	.1311	.1300	2.622	2.60	2.611	9.7389
17	.1184	.1205	2.368	2.41	2.389	9.7611
18	.0400	.0380	.80	.72	.76	9.924
19	.1270	.1270	2.54	2.54	2.54	9.746
20	.0675	.0660	1.35	1.32	1.335	9.8665
21	.2280	.2260	4.56	4.52	4.54	9.546
22	.0885	.0865	1.77	1.73	1.75	9.825
23	.2278	.2283	4.556	4.566	4.561	9.5439
24	.1023	.1020	2.046	2.04	2.043	9.7957
25	.0960	.0960	1.96	1.92	1.94	9.806
26	.0875	.0875	1.75	1.75	1.75	9.825
27	.1145	.1150	2.29	2.30	2.295	9.7705
28	.1565	.1545	3.13	3.09	3.11	9.689
29	.0730	.0738	1.46	1.474	1.467	9.8533
30	.0960	.0945	1.92	1.89	1.905	9.8095
31	.0890	.0890	1.78	1.78	1.78	9.822
32	.3557	.3538	7.114	7.076	7.095	9.2905
33	.0945	.0955	1.89	1.91	1.90	9.81
34	.1480	.1488	2.96	2.976	2.968	9.7032
35	.1225	.1210	2.45	2.42	2.435	9.7565
36	.0988	.0970	1.976	1.94	1.958	9.8042
37	.0892	.0900	1.784	1.80	1.792	9.8208

Table 2 continued

Soil	Wt of moisture in 5 grams soil		Percent		Average %	Dry matter in 10 grams of soil
38	.1095	.1080	2.19	2.16	2.175	9.7825
39	.0927	.0940	1.854	1.88	1.867	9.8133
40	.1110	.1100	2.22	2.20	2.21	9.779
41	.1123	.1115	2.246	2.23	2.238	9.7762
42	.0460	.0453	.92	.906	.913	9.9087
43	.1113	.1105	2.226	2.21	2.218	9.7782
44	.1122	.1140	2.244	2.28	2.262	9.7738
45	.0835	.0815	1.67	1.63	1.65	9.835
46	.0500	.0515	1.00	1.03	1.015	9.8985
47	.1807	.1828	3.614	3.656	3.635	9.6365
48	.1295	.1315	2.59	2.63	2.61	9.739
49	.1175	.1150	2.35	2.30	2.325	9.7675
50	.0993	.0993	1.986	1.986	1.986	9.8014
51	.1140	.1150	2.28	2.30	2.29	9.771
52	.1975	.1955	3.97	3.87	3.92	9.603

Methods used in analysis

The nitrogen was determined according to Kjeldahl method and the phosphorus according to the acid soluable method, both of which are discribed in the guide used in the Soil Fertility laboratory of the University of Illinois.The method used to determine potassium was the same as the one described in this guide except that barium hydroxide was not used to precipitate with to begin with but Calcium Carbonate in hot solution.

Table 3a nitrogen in red brown silt loam

Soil	cc ammonia distilled from 10grs of soil		Nitrogen in 1cc ammonia	Drymatter in 10 grs soil	percent nitrogen		average%	Pounds nitrogen in the surface soil per acre 7 inches
4	5.4	5.2	.002137	9.6723	.1193	.1158	.11755	2351
5	4.2	4.3	.002137	9.5974	.0955	.0957	.0956	1892
7	5.95	5.95	.002137	9.6365	.13193	.13193	.13193	2639
8	5.53	5.47	.002137	9.6617	.1223	.1210	.12165	2433
10	5.25	5.15	.002137	9.569	.1172	.1150	.1166	2232
13	5.6	5.65	.002137	9.5833	.12487	.12599	.12543	2509
15	5.05	5.1	.002137	9.67895	.1115	.1126	.11205	2241
16	4.75	4.85	.002137	9.7389	.1042	.1064	.1053	2106
17	4.3	4.25	.002137	9.7611	.09414	.09294	.09354	1871
18	2.9	3.0	.002137	9.924	.0614	.0646	.0625	1250
27	1.15	1.25	.002631	9.7705	.0313	.0306	.03245	649 +
43	4.05	3.95	.002631	9.7782	.1090	.1063	.10765	2143
45	5.55	5.35	.002631	9.835	.1485	.1454	.14675	2939
46	2.95	3.05	.002631	9.8985	.0784	.0811	.07975	1595
48	5.8	5.6	.002329	9.739	.1387	.1317	.1352	2704
49	3.85	4.05	.002631	9.7675	.1037	.1090	.10635	2127
52	3.9	3.9	.002329	9.603	.0945	.0945	.0945	1890
Average								2187

+Not taken in consideration because below average

Table 3b nitrogen in brown clayey silt loam

Soil	cc ammonia distilled from 10grs of soil	Nitrogen in 1cc ammonia	Drymatter in 10 grs soil	percent nitrogen	average %	Pounds nitrogen surface soil per acre 7inches
2	4.05 3.95	.002631	9.57375	.1098 .1111	.11645	2209
3	4.1 3.9	.002137	9.573	.0915 .0810	.0882	1764
6	5.56 5.6	.002137	9.6428	.1232 .1241	.1237	2474
9	6.95 7.05	.002137	9.6475	.1539 .1561	.15505	3101
12	5.82 5.73	.002137	9.5357	.12935 .12617	.12776	2555
14	5.5 5.55	.002137	9.6084	.1223 .1234	.1229	2458
19	6.23 6.26	.002073	9.746	.1325 .1331	.1328	2656
47	3.95 3.95	.002631	9.6365	.1078 .1078	.1078	2156
11	5.89 5.91	.002137	9.64	.1306 .1310	.1308	2616
Average						2443.2

Table 3c nitrogen in the red sand

21	0	0	9.646	0	0	0
22	4.9 4.7	.002073	9.625	.1042 .1009	.19255	2051
24	3.48 3.45	.002631	9.7957	.0935 .0936	.09305	1861
25	3.48 3.45	.002631	9.806	.0933 .0926	.09295	1859
28	1.25 1.45	.002631	9.6890	.0340 .0394	.0367	734
34	5.45 5.65	.002329	9.7032	.1308 .1317	.13135	2625
36	1.2 1.1	.002631	9.8042	.0322 .0295	.03085	617
Average except No 21						1624.5

Table 3d nitrogen from greyloam

Soil	cc ammonia distilled from 10grs of soil		Nitrogen in 1cc ammonia	Drymatter in 10grs soil	percent nitrogen		average	Pounds nitrogen surface soil per acre 7inches
1	7.2	7.35	.002137	9.5759	.15765	.16184	.15956	3191
20	.66	.74	.002073	9.8665	.01389	.01555	.0142	284
23	.55	.55	.002631	9.5439	.0151	.0151	.0151	302
26	.45	.55	.002631	9.825	.0121	.0147	.0134	268
29	1.15	1.35	.002631	9.8533	.0317	.0361	.0339	678
30	.85	1	.002631	9.8095	.0228	.0268	.0248	496
31	3.25	3.05	.002631	9.822	.0871	.0817	.0844	1688
32	.3	.2	.002631	9.2905	.0085	.0056	.00705	141
33	2.85	2.95	.002631	9.81	.0765	.0792	.07795	1559
37	2.15	1.95	.002631	9.8208	.0839	.0787	.0813	1626
38	5.9	6.1	.002329	9.7825	.1404	.1452	.1428	2856
39	5.3	5.15	.002631	9.8133	.1421	.1376	.13985	2797
40	3.65	3.85	.002631	9.779	.0982	.1036	..1009	2018
41	4.7	4.9	.002329	9.7762	.1119	.1167	.1143	2286
42	1.45	1.35	.002631	9.9087	.0385	.0359	.0372	744
44	1.25	1.35	.002631	9.7738	.0337	.0364	.03505	701
50	2.85	2.75	.002631	9.8014	.0767	.0738	.07525	1505
51	8.23	8.37	.002329	9.771	.1982	.1994	.1988	3976
Average soil No 32								1579

Table 3e nitrogen from light brown silt loam

Soil	cc ammonia distilled from 10grs of soil	Nitrogen in 1cc ammonia	Dry matter in 10grs soil	percent nitrogen	average%	Pounds nitrogen surface soil peracre 7inches
35	4.65 4.65	.002631	9.7565	.1254 .1254	.12 54	2:08

Table 4 Phosphorus

Soil	M. grs P_2O_5	Average	M grs phosphorus	% P	Pounds per acre 7inches
1	3.65 3.5	3.575	1.5623	.0391	782
2	3.6 3.5	3.55	1.5514	.9386	776
3	3.6 3.8	3.7	1.6169	.0404	808
4	2.7 2.5	2.6	1.1362	.0284	568
5	4.5 4.3	4.4	1.9228	.0481	962
6	3.5 3.4	3.45	1.5077	.0377	754
7	3.8 3.6	3.7	1.6169	.0404	808
8	3 2.85	2.925	1.2782	.032	640
10	4 4	4	1.748	.0437	874
11	4.1 4.1	4.1	1.7917	.0448	896
12	4 4	4	1.748	.0437	874
13	3.4 3.3	3.35	1.464	.0366	732
14	3.85 3.8	3.825	1.6715	.0418	836
15	3.5 3.4	3.45	1.5077	.0378	756
Average					790.4

Table 5 Potassium

Soil	Wt of K_2PtCl_6	Percent potassium	Average %	Pounds per acre 7inches
1	.0490 .0502	.3945 .4041	.3993	7986
2	.0868 .0870	.6987 .7004	.69955	13991
3	.0836 .0850	.6730 .6843	.67865	13573
4	.0728 .0730	.5860 .5877	.58685	11737
5	.0876 .0870	.7052 .7004	.7028	14056
6	.1030 .1064	.8293 .8565	.8429	16856
7	.0950 .0940	.7648 .7567	.76075	15215
9	.0600 .0620	.483 .4991	.49105	9821
11	.0782 .0782	.6295 .6295	.6295	12590
12	.0810 .0814	.6529 .6545	.6537	13074
13	.0764 .0774	.615 .6231	.61905	12381
14	.0680 .0662	.5474 .5329	.54015	10803

Conclusions

In order to see what this work means it is well to compare these soils with some standard and the normal fertile soil. U.S. and Ger. average has been selected. It has 5800lb of nitrogen, 2000lb of phosphorus, and 6300lb potassium per acre foot.

To compare first the nitrogen in the normal soil with that of any of the soils analized it will readily be seen that they are quite low. Take for instance the average of the red brown silt loam from table 3a. It has about 2100lbof nitrogen; while the normal fertile soil has 5800lb, or considerably more than

two and a half times as much.The brown clayey silt and the brown silt loam have a little higher average nitrogen content than the brown silt loam mentioned above,as can be seen in table 3;while the red sand and grey loam are quite a little lower.Probably the relative nitrogen values of these various soils can be better brought in an other way,however.Suppose that these soils will produce maximum crops every year how many such crops can be grown before all of the nitrogen is removed,if there is no nitrogen added or taken away except by the crop? IN table 6 below it is shownwith several agricultural plants how much nitrogen is removed in each crop and how many crops it would take to remove all of the nitrogen in each of the soils mentioned.

Table 6

	Nitrogen removed	Number of maximum crops that can be produced on					
		Normal soil	reddish brown silt loam	brown clayey silt loam	grey loam	light brown silt loam	red sand
Corn	149 lb	39	14	16	10	17	11
Oats	69	84	32	37	23	36	23
Wheat	65	89	32	37	24	38	25
Timothy	48	121	39	51	33	52	34
Sugar beets	100	38	21	24	15	25	16

The maximum crops per acre were taken for corn as 100 bushels of grain 3 tons of stover,for oats 75 bushels of grain 2 tons of straw.

for wheat 40 bushels of grain 2 tons of straw, for timothy 2 tons, and for sugar beets 20 tons. Of course it would be impossible to get maximum crops until all of any kind of plant food was gone. As the plant food is diminished the crops get smaller and smaller until even before the nitrogen, for instance, is all exhausted the land will quit producing. This does not affect the value of the table for it is comparative rather than absolute. In other words it shows the relative nitrogen content of the soils and the rate at which these soils will become unproductive, as far as nitrogen is concerned, barring the influence of other conditions.

Studying the phosphorus of the soils in the same way the following table 7 is obtained.

Table 7

	Pounds of phosphorus in 1 crop	Number of maximum crops that can be produced on normal soil	soils analyzed (average)
Corn	25 lb	87	34
Oats	11	184	72
Wheat	10	200	79
Timothy	6	333	132
Sugar beets	18	110	44

The normal fertile soil has 2000 lb phosphorus to the depth of 7 inches while the average of the soils analyzed is only 790 lb which, as is shown in table 7, will produce far fewer crops than the normal fertile soil. In this average the grey loam, the reddish brown silt loam, and the brown clayey silt loam are repersented. They were not

separated into types as they were for nitrogen for the average of the phosphorus for each of the types was practically the same and the main thing to be noted is that they all have a great deal less phosphorus than does the normal fertile soil.

The soils analized are not compared to the normal fertile for potassium as they were for nitrogen and phosphorus for while they are very poor in phosphorus and nitrogen they are rich in potassium. All that needs to said is that the normal fertile soil has 5300# of potassium while the poorest one of these has nearly 8000# and the best 17000#.